Expert Group- Growing Wheat

Wheat, is the name given to several plants in the genus *Triticum* including *Triticum aestivum*, *Triticum compactum*, *Triticum spelta* and *Triticum durum*. All are annual or biennial grasses grown primarily for their grain. Wheat species have an erect smooth stem with linear leaves that grow in two rows on either side of the stem with larger 'flag' leaves at the top of the stem. The stem terminates in a spike that is made up on individual spikelets, each with 3–9 florets. The wheat fruit develops within the spikelets, maturing to a seed (kernel).

Wheat can reach 1.2 m (4 ft) in height and like other cereals, has been developed into different varieties that are adapted to planting at different times of the year. Spring wheat is planted for a late summer harvest, whereas Winter wheat is planted for harvesting in early to mid-summer. Overwintering varieties are more commonly grown in regions with mild winters. Wheat may be referred to by variety and these include durum or macaroni wheat (*Triticum durum*), club wheat (*Triticum compactum*), spelt wheat (*Triticum spelta*) and bread wheat (*Triticum aestivum*).

Wheat is actually a member of the grass family. More than 17,000 years ago, humans gathered wheat seeds from the plants and used them for food. Wheat is believed to have originated in the Tigris and Euphrates river valley, near what is now Iraq.

The United Nations believes that at least 20% of all calories consumed by humans are from wheat. The complex carbohydrates in grain-based foods provides essential fuel for our bodies. Wheat is used to make white bread, pastries, pasta, and pizza- and has been a very important crop all over the world since the 18th century. It was first introduced to America by the early English colonists and it quickly became the main cash crop of farmers. While it is used primarily to produce flour for bread, it is used widely in the production of many other baked goods. Wheat grain is also used in the manufacture of alcoholic beverages and alcohol. Wheat straw is used as an animal feed and in the manufacture of carpets, baskets, packing, bedding, and paper.

Today, wheat is the primary grain used in U.S. grain products- as about three-quarters of all U.S. grain products are made from wheat flour. It is grown in 42 states across the U.S., with Kansas being the biggest wheat producer and North Dakota coming in second.

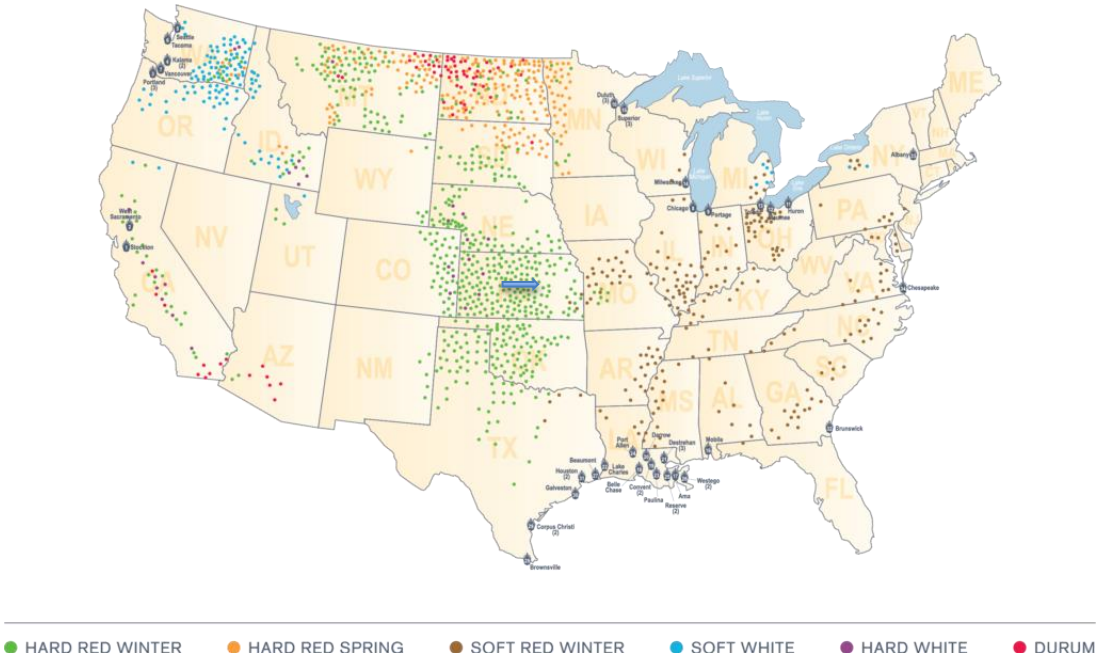

Figure 1: Wheat Grown By Region/ Image Credit: National Association of Wheat Growers

Watch this short video (2:30) called "*How Wheat Grows*" from the National Association of Wheat Growers. What do you think farmers need in order to grow wheat? What kind of weather conditions does a wheat crop need to be successful? Read this blog from the National Wheat Foundation to give more details on the role of agriculture to the consumer.

There are many different varieties of wheat. Wheat yield and quality is determined by the genetic potential of the variety of wheat interacting with the environment in which it is planted. Breeders are continuously working to develop improved varieties by fine-tuning some of the genetic make-up of the wheat seeds. The research shows that this does result in an increase in both the yield and quality of the wheat while and helping to adapt the crop to regionally specific biotic and abiotic stresses. You can learn about the International Wheat Genome

Sequencing Consortium's efforts to improve wheat products in this short video (3:12).

There is research being conducted all over the world to try to improve the quality of wheat crops. This research includes better understanding the diseases, insects, and even looking closely at the biochemical, molecular, and genetic properties of wheat seeds. You can learn more about some of the research being conducted in the U.S. here.

All varieties of wheat grow best in a well-drained loamy soil. A loamy soil is one that is composed mostly of sand, silt, and a smaller amount of clay. NASA's Land Data Assimilation System (LDAS) is able to create the map of the different soil texture types across the U.S. You can compare this map to the one in figure 1 to see the correlation between where wheat is grown in the U.S. and where NASA satellite data has identified loamy textured soil.

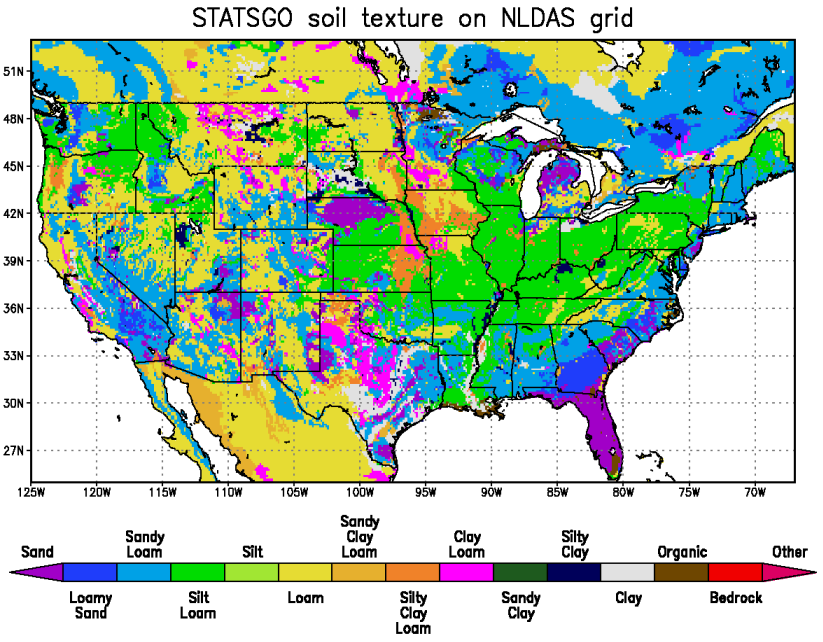

Figure 2: Image credit: NASA

Wheat grows best when the temperatures are warm, around from 21° to 24° C/ 70° to 75° F, but are not too hot. Wheat also needs a lot of sunshine, especially when the grains are beginning to fill out.

Wheat grows best in temperatures between 21ºC/70ºF and 24ºC/75º F. The minimum temperature that wheat can handle during its growth cycle is about4ºC/ 40ºF. Wheat does not grow well if temperatures exceed 35ºC/95º F. Wheat will grow optimally in a deep, fertile, well-draining and well aerated soil at a pH between 5.5 and 7.5.

In both Kansas and Pakistan, most farmers use winter wheat varieties. In Kansas, the winter wheat is planted between September and November, and is harvested in June or July. In Pakistan, winter wheat is planted in November or December and is harvested earlier, in April or May, as the weather becomes too hot during the summer months. Farmers in both locations need to remain alert to the changing weather conditions as well as changes in climate which might impact their wheat growing season. There is evidence that climate change is already having an impact on wheat production and yield.

In the U.S., farmer produce about 1.9 billion bushels of wheat every year. A bushel is equal to 60 pounds of wheat grain, which is enough to bake 90 loaves of bread. While there are several different varieties of wheat which are grown in the U.S., for this activity we are focusing on the variety of wheat that is being grown in central Kansas. Looking at the map in figure 1, which variety of wheat is grown in Gypsum? HRW (hard red winter) wheat accounts for more than 41% of the wheat that is produced in the U.S. You can learn more about this wheat variety here.

Figure 3: Wheat farming in Kansas Image credit: NRCS Kansas

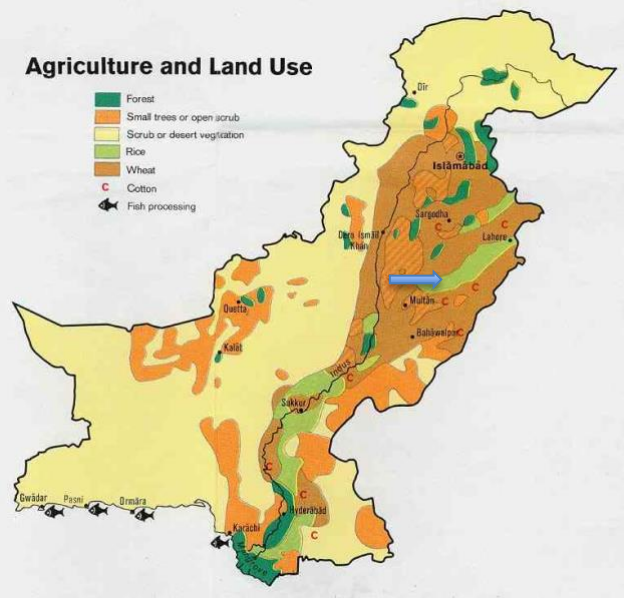

Figure 4: Agriculture and Land Use in Pakistan

Let's compare and contrast the type of wheat and the wheat growing season for our other location in Sargodha, Pakistan. Figure 4 shows the way that the land is used for agriculture and other uses in Pakistan. Sargodha is located in the northeast in the Punjab region, and we can see that it is in the heart of the wheat growing region.

According to the Food and Agriculture Organization of the united Nations, wheat is the most important crop grown in Pakistan. Wheat is grown by 80% of the farmers on close to 40% of the country's total cultivated land. Most wheat is grown on small farms by those whose livelihood depends on their wheat crop. Pakistan also grows its wheat crop during the winter. The wheat is sowed in November and December and goes dormant when the weather turns cold. The harvesting in the Punjab district takes place in April and May, as it gets too hot for wheat to grow effectively after May. In Punjab, wheat is mostly grown on irrigated land. Wheat production from rainfed areas is only about 10 % of the total wheat crop. Therefore, weather causes year-to-year fluctuations in crop production, and good rainfall means a good wheat crop.

As you might imagine, freshwater is an essential natural resource that is needed to produce wheat. The USGS (United States Geological Survey)

says that it takes about 731 liters/193 gallons of water to produce a one-pound loaf of bread, and about 80% of that water (~584 liters/154 gallons) went into growing the wheat. During the period of 1996-2005, global wheat production used about 15% of the total water "footprint" being used to irrigate all kinds of crops around the world. Another way to think about it is that wheat needs about 31 to 38 centimeters/12 to 15 inches of water per growing season to produce a good crop.

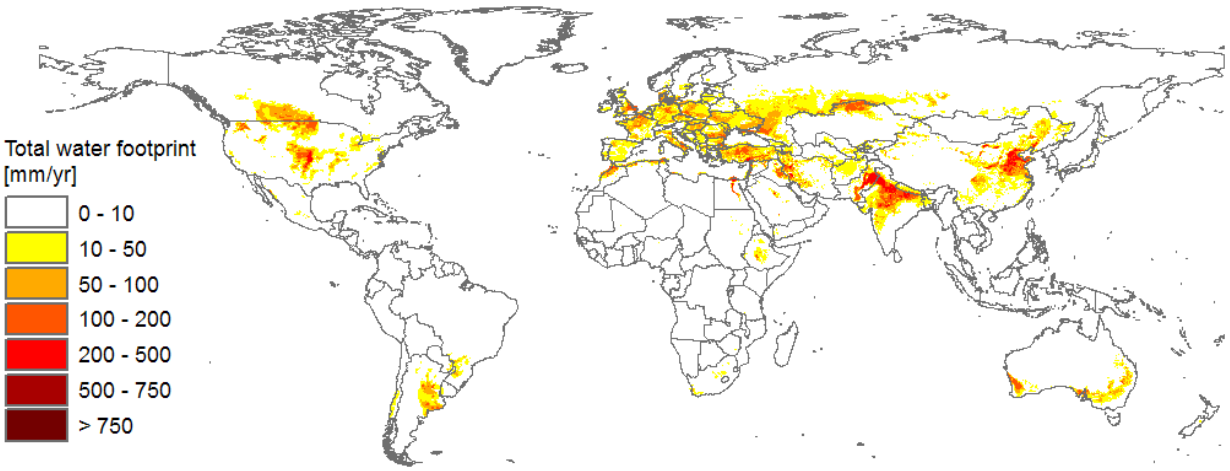

Figure 5: Global Water Footprint for Wheat Production/ Image credit: Mekonnen and Hoekstra (2010)

Resources:

- National Association of Wheat Growers
- USGS
- Britannica Kids: Wheat
- Wheat Fact sheets
- Wheat Facts- Kansas wheat
- International Wheat Genome Sequencing Consortium
- NASA's LDAS soils database
- National Ag Day: Let's Celebrate Wheat!
- Food and Agriculture Organization of the United Nations